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A

UTILITY PATENT APPLICATION
TRANSMITTAL

((Only for new non-provisional applications under 37CFR 1.53 (b))

Attorney Docket No.	47440-018000
Total Pages	29
First Named Inventor	Tunney, Joseph P.
Express Mail Label No.	EL368262572US

APPLICATION ELEMENTS
See MPEP chapter 600 concerning utility patent application contents.ADDRESS TO: Assistant Commissioner for Patents
Box PATENT APPLICATION
Washington, DC 20231

1. ☒ Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)
2. ☒ Specification [Total Pages 18]
(preferred arrangement set forth below)
 - Descriptive title of the Invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
3. ☒ Drawing(s) (35 USC 113) [Total Pages 4]
4. ☒ Oath or Declaration [Total Pages 4]
 - a. ☒ Newly executed (original or copy)
 - b. ☐ Copy from a prior application (37 CFR 1.63 (d))
(for continuation/divisional with Box 17 completed)
[Note Box 5 below]
 - i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting
inventor(s) named in the prior application,
see 37 CFR 1.63 (d) (2) and 1.33 (b).
5. ☐ Incorporation by Reference (useable if Box 4b is checked)
The entire disclosure of the prior application, from which a
copy of the oath or declaration is supplied under Box 4b,
is considered as being part of the disclosure of the
accompanying application and is hereby incorporated by
reference therein.

6. ☐ Microfiche Computer Program (Appendix)
7. ☐ Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)

ACCOMPANYING APPLICATION PARTS

8. ☐ Assignment Papers (cover sheet & document(s))
9. ☐ 37 CFR 3.73 (b) Statement (when there is an assignee) ☐ Power of Attorney
10. ☐ English Translation Document (if applicable)
11. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
14. ☐ Small Entity Statement(s) ☐ Statement filed in prior application, Status still proper and desired
15. ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)
16. ☒ Other Patent Cover Sheet and Certificate of Express Mailing

17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:
- ☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No:

18. CORRESPONDENCE ADDRESS

☐ Customer number or bar code label

(Insert Customer No. or Attach bar code label here)

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as Express Mail in an envelope addressed to: Box PATENT APPLICATION / Assistant Commissioner for Patents / Washington, D.C. 20231 on this date: October 12, 2000 (Express Mail Label No. Above)

Typed or printed name

Catherine N. Hunter

Signature

Date

October 12, 2000

FEE TRANSMITTAL

Note: Effective November 10, 1998
Patent fees are subject to annual revision

Complete if Known

Application Number	unassigned
Filing Date	October 12, 2000
First Named Inventor	Tunney, Joseph P.
Title	A System for Cleaning Pressurized Containers
Group Art Unit	unassigned
Examiner Name	unassigned
Attorney Docket Number	47440-018000

TOTAL AMOUNT OF PAYMENT \$710.00

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to:

Deposit Account

Deposit Account Name

- ☒ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17 ☐ Charge the Issue Fee Set in 37 CFR 1.18 at the Mailing of the Notice of Allowance

2. ☐ Payment Enclosed:

☐ Check ☐ Money ☐ Other Order

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Fee Code	Entity Fee (\$)	Small Fee Code	Entity Fee (\$)	Fee Description	Fee paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	390	216	195	Extension for reply within second month	
117	890	217	445	Extension for reply within third month	
118	1,390	218	695	Extension for reply within fourth month	
128	1,890	228	945	Extension for reply within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,210	241	605	Petition to revive - unintentional	
142	1,240	242	620	Utility issue fee (or reissue)	
143	440	243	220	Design Issue fee	
144	600	244	300	Plant Issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	760	246	380	Filing a submission after final rejection (37 CFR 1.129(a))	
149	760	249	380	For each additional invention to be examined (37 CFR 1.129(b))	
Other fee (specify) _____					
Other fee (specify) _____					

FEE CALCULATION

1. FILING FEE

Large Fee Code	Entity Fee (\$)	Small Fee Code	Entity Fee (\$)	Fee Description	Fee Paid
101	710	201	355	Utility filing fee	710
106	320	206	160	Design filing fee	
107	490	207	245	Plant filing fee	
108	710	208	355	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL 710

2. CLAIMS

	Highest No. Paid For	Extra	Fee from below	Fee Paid
Total Claims	20	-20 =	0	0
Independent Claims	1	-3 =	0	0
Multiple Dependent Claims				

Large Fee Code	Entity Fee (\$)	Small Fee Code	Entity Fee (\$)	Fee Description
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	270	204	135	Multiple dependent claims
109	80	209	40	Reissue independent claims over original patent
110	18	210	9	Reissue claims in excess of 20 and over original patent

SUBTOTAL 0

Reduced by Basic Filing Fee Paid **SUBTOTAL (3)**

SUBMITTED BY

Typed or Printed Name Margaret M. Duncan

Signature

Margaret M. Duncan

Date

October 12, 2000

Complete (if applicable)

Reg. Number

30,879

Deposit Account

13-0206

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 09/689424
 Jc927 U.S. PTO

In re Appln. of Tunney et al.
New U.S. Patent Application
"A System for Cleaning Pressurized Containers"
Docket No.: 47440-018000

Jc927 U.S. PTO
09/689424
10/12/00

CERTIFICATE OF MAILING BY "EXPRESS MAIL"

"Express Mail" mailing label number EL368262572US

Date of Deposit: October 12, 2000

I hereby certify that the following documents:

1. Specification, claims and abstract (18 pp.);
2. Patent Cover Sheet (1 pp.);
3. Figs. 1-4B (4 sheet);
4. Utility Patent Application Transmittal (1 pp.);
5. Executed Combined Declaration and Power of Attorney (4 pp.);
6. Fee Transmittal (1pp. - in dup.);
7. Certificate of Express Mailing (1 pp.) and
8. Return Postcard.

are being deposited with the United States Postal Service "Express Mail Post Office To Addressee" Service under 37 C.F.R. 1.10 on the date indicated above and is addressed to: Assistant Commissioner for Patents, Box New Patent Application, Washington, D.C. 20231.

Catherine N. Hunter
(Typed or printed name of person mailing paper or fee)

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A SYSTEM FOR CLEANING PRESSURIZED CONTAINERS

5 **Field of Invention**

 The present invention relates to a system for cleaning pressurized containers having chemicals contained therein. Specifically, the present invention relates to a system for cleaning pressurized containers such as, for example, rail tank cars, mobile tanks or the like. Further, the chemicals may be any material stored under pressure that may be
10 difficult to collect and dispose of due to the hazardous characteristics thereof.

Background of the Invention

 It is, of course, generally known to store and/or transport chemicals having hazardous characteristics via pressurized containers. Further, it is also generally known to clean these containers using a variety of methods and systems. In the past, cleaning
15 pressurized containers entailed venting excess gaseous material to the atmosphere. Further, unpressurized containers contained bottom hatches or valves for draining liquid chemicals. However, many hazardous chemicals escaped into the environment thereby causing health risks for humans, vegetation and wildlife. With the advent of environmental standards and compliance, however, venting or draining hazardous
20 chemicals to the environment has generally become illegal. Today, the chemicals are typically routed to a flare to be incinerated or otherwise collected for disposal.

 However, while some of the gases contained within the containers may be relatively easy to recover and dispose of by venting of the pressurized containers to a flare, it is difficult to remove all of the gases contained therein. Further, liquid product
25 may remain inside a container after cleaning. Typical systems and methods of cleaning may involve injecting the container with a quantity of steam that may aid in bringing the liquid chemicals to the gaseous phase and removing the steam/gaseous chemical product combination for incineration or disposal. However, problems may occur using steam to remove chemicals from pressurized containers since steam may condense within the
30 container forming liquid water or ice. The liquid water or ice may mask the presence of

the chemicals from detectors. Further, the liquid water or ice may interfere with the removal of the chemicals from the container.

Another method of removal, especially for unpressurized containers having liquid therein, may include entering the container to manually remove the chemical. While this may be a relatively efficient and thorough way to remove the chemical from the container, it may be very dangerous, as it requires an individual to actually enter the container thereby exposing the individual to the chemicals contained therein. Further, by opening the container, there may be a significant risk that some of the chemicals may escape into the environment.

Therefore, an improved system of cleaning pressurized containers is necessary. Particularly, a system is needed that overcomes the problems associated with typical cleaning systems. Further, a system is needed that cleanly and efficiently moves chemical product from a pressurized container and transports the waste product to a proper disposal system such as a flare for incineration.

Summary of the Invention

The present invention relates to a system for cleaning a pressurized container having chemicals therein. More specifically, the present invention allows containers such as, for example, rail tank cars, to be cleaned safely and efficiently without risking exposure of the chemicals to people or the environment. The invention entails injecting heated and pressurized nitrogen gas into the container thereby purging the container of any chemical therein to form a nitrogen/chemical mixture. The nitrogen/chemical mixture may then be sent to a flare for incineration. Further, the heated nitrogen gas may aid in pulling the chemical out of the container and transporting the chemical to the flare for incineration.

To this end, in an embodiment of the present invention, a system for cleaning pressurized containers containing chemicals is shown comprising: a container having a quantity of chemicals therein wherein the container has a plurality of valves for attaching a plurality of pipes thereto; a nitrogen storage tank having a first pipe extending therefrom and attachable to a first valve on the container; a heating means wherein the first pipe is

heated by the heating means; and a flare having a second pipe extending therefrom and attachable to a second valve on the container.

In an embodiment of the present invention, the system is mobile.

In an embodiment of the present invention, the container is a rail tank car.

5 In an embodiment of the present invention, the container is disposed on a vehicle.

In an embodiment of the present invention, the container further comprises a boiler for boiling water to feed into the heating means.

10 In an embodiment of the present invention, the container further comprises a nitrogen vaporizer attached to a second section of the first pipe for vaporizing the nitrogen from the nitrogen storage tank.

In an embodiment of the present invention, the system further comprises a liquid pipe attached to the first valve wherein the liquid pipe extends to a bottom of the container.

15 In an embodiment of the present invention, the system further comprises a vapor pipe attached to the second valve and extending partially within the container.

In an embodiment of the present invention, the system further comprises a protective housing disposed on a top of the container wherein the protective housing houses the plurality of valves.

20 In an embodiment of the present invention, the protective housing has a removable lid to gain access to the plurality of valves therein.

In an embodiment of the present invention, the system further comprises a pressure plate on a top of the container wherein the pressure plate provides access to the interior of the container.

25 In an embodiment of the present invention, the system further comprises a platform situated adjacent the top of the container to aid an individual in gaining access to the top of the container.

In an embodiment of the present invention, the system further comprises a plurality of sideports on the protective housing wherein the sideports provide access to the plurality of valves housed within the protective housing.

30 The system of claim 1 wherein the flare incinerates a plurality of chemicals.

In an embodiment of the present invention, the flare incinerates both liquefied petroleum gas and anhydrous ammonia.

In an embodiment of the present invention, the flare has an inlet pipe for adding air within the flare.

5 In an embodiment of the present invention, the system further comprises a blower for blowing air through the inlet pipe into the flare.

In an embodiment of the present invention, the system further comprises a natural gas inlet attached to the flare for feeding natural gas to the flare.

10 In an embodiment of the present invention, the system further comprises a pressure gauge attached to one of the plurality of valves for measuring the pressure within the tank.

In an embodiment of the present invention, the system further comprises a control panel having a plurality of switches for controlling the system.

15 It is, therefore, an advantage of the present invention to provide a system for cleaning a pressurized container having a quantity of chemicals therein that safely and efficiently removes chemicals from the container. Moreover, it is advantageous that the present invention removes chemicals from the container without risking exposure to people or the environment.

20 Further, it is an advantage of the present invention to provide a system for cleaning a pressurized container having a quantity of chemicals therein that allows the chemicals to be removed without causing damage to the container by freezing the container or pipes connected thereto. In addition, an advantage of the present invention is that the heated nitrogen gas used to remove the product will not condense within the container and therefore will not mask the presence of the chemicals therein.

25 Another advantage of the present invention is to provide a system for cleaning a pressurized container having a quantity of chemicals therein that is largely automatic and therefore allows an individual to monitor the process without exposing the individual to the chemicals. Additionally, an advantage of the present invention is that a plurality of types of containers may be cleaned using the system and method defined herein, including, but not limited to, rail tank cars and other like containers.

Additional features and advantages of the present invention are described in and will be apparent from, the detailed description of the presently preferred embodiments and from the drawings.

Brief Description of the Drawings

5 **Figure 1** illustrates an inspection process in an embodiment of the present invention for pressurized containers to be used prior to the cleaning of the containers by the heated nitrogen.

Figure 2 illustrates a heated nitrogen gas cleaning process for the pressurized containers.

10 **Figure 3** illustrates a steam cleaning process for the pressurized containers to be conducted after the heated nitrogen process.

Figure 4A illustrates a cleaning system for pressurized containers, such as, for example, for rail tank cars in an embodiment of the present invention. Further, **Figure 4B** illustrates a protective housing, headspace, valves and sideports situated atop a container.

15 **Detailed Description of the Presently Preferred Embodiments**

 The present invention relates to a system for cleaning pressurized containers such as, for example, rail tank cars and the like. More specifically, the present invention provides a system for cleaning pressurized containers that includes but is not limited to, injecting heated, pressurized nitrogen gas into a container having a quantity of chemicals
20 therein. The nitrogen gas purges the container of the chemical or chemicals contained therein. The chemical or chemicals may then be transported to a flare for incineration or may otherwise be collected for disposal. The flare may be configured to incinerate any number of chemicals as may be apparent to those skilled in the art, such as, for example, liquefied petroleum gas and/or anhydrous ammonia. The present invention allows the
25 containers to be cleaned quickly, safely and efficiently without exposing individuals to undue risk.

 Referring now to the drawings, wherein like numerals refer to like features, Figures 1 to 3 show three embodiments of a cleaning method according to the present invention. Further, Figures 4A and 4B illustrate a cleaning system for a container, such as
30 for a rail tank car, whereby the container may be cleaned. Although this system for

cleaning containers may be utilized with any pressurized container apparent to those skilled in the art, mobile or immobile, the system herein described relates specifically to rail tank cars or other mobile container situated atop a plurality of rails.

A rail tank car may include, but may not be limited to, a pressurized container 402 on a plurality of rail wheels 401 (also called a truck) allowing the container 402 to be transported on a track 403 from one location to another. It should be noted that rail tank cars may include any mobile container apparent to one skilled in the art. Typical rail tank car containers may have a protective housing 406 atop the container 402. The protective housing 406 have a plurality of valves 408,410 (as shown in Figure 4B) contained therein for attaching pipes or lines thereto. Valve 408 may be a vapor-type valve that may typically be utilized to remove vapors from the container 402. The valves 410 may be liquid-type valves that may allow a liquid chemical to be added or removed from the container. Typically, the liquid valves 410 may be connected to pipes that may go to the bottom of the container 402. Alternatively, the vapor valve 408 maybe connected to a pipe that merely goes to space near the top of the container 402. Although many rail tank cars may have only three valves within the protective housing 406, this invention should not be limited in that regard. Any number and type of valves may be contained within the protective housing 406. Moreover, the valves need not be located only within the protective housing. Valves may be located in any location on the container 402 to remove or add materials to the container 402.

A pressure plate (not shown) may be included within the protective housing 406 that may be openable to allow an individual to gain access to an interior of the container 402. The pressure plate may be disposed on the bottom of the protective housing 406 and may be fixed to the container 402 via bolts (not shown). When an individual wishes to gain access to the interior of the container 402, the pressure plate may be removed by removing the bolts. To remove the pressure plate, the protective housing 406 and valves 408,410 should be removed from the container 402. However, the pressure plate may be disposed anywhere on the container 402 as may be apparent to those skilled in the art.

The protective housing 406 may be opened via a lid 412 to gain access to the valves 408,410 and headspace 413 that may be contained therein. Further, the protective

housing 406 may have at least three sideports 404 for gaining access to the valves 408,410 within the protective housing 406 without opening the protective housing 406 by the lid 412.

The container 402 may contain any chemical or chemicals that may be apparent to those skilled in the art. Further, the chemicals may be of a hazardous nature that may pose a risk to individuals exposed to the chemical. Specifically, the chemical or chemicals may typically be in gaseous form when under standard temperature and pressure. However, the chemical or chemicals may be a liquid when stored under pressure within the container 402. Typical chemicals that may be stored within the container may include, but may not be limited to, liquefied petroleum gas ("LPG") and/or anhydrous ammonia ("AA"). LPG may include, but may not be limited to, the following chemicals: butane, isobutane, propane, propylene, butylenes and other chemicals apparent to those skilled in the art. HAWLEY'S CONDENSED CHEMICAL DICTIONARY 703 (12th ed. 1993). Moreover, LPG may include mixtures of these materials. LPG is typically extremely flammable when in gaseous form. Moreover, other chemicals that may be stored within the containers that may be cleaned using the system and methods described herein may be butadiene, butene, butyne, cyclobutane, cyclopropane, dimethyl propane, ethane, ethylene oxide, propyne, ethylene, methyl butene, methyl ether, methyl propene, 1,3-pentadiene and other chemicals apparent to those skilled in the art.

Referring now to Figure 1, an inspection process 1 is shown that may be instituted prior to cleaning the container 402 via the cleaning process described herein with reference to Figures 2 and 3. The container 402 may be carefully preliminarily inspected via a "search container" step 10. Specifically, an inspector may move around the container 402 looking for evidence of leakage of the chemicals via step 12. Leaks may be apparent by wet spots, corrosion in a particular area, hissing or the like. Of course, the inspector should wear applicable safety clothing and equipment and approach the container from upwind to protect the inspector from the deleterious effects of any leaking chemical. Further, the inspector may use a catwalk 405 or other structure to allow the inspector to inspect all areas of the container 402 including the top of the container 402. Likewise, the inspector may use a ladder 407 to get relatively close to the protective housing 406 and the

valves 408, 410 contained therein. This preliminary inspection may be done by visually searching for leaks around the container 402 and any valves or pipes protruding therefrom. If the inspector sees evidence of leakage, then the process 1 may be halted while the inspector or other individual assesses the leak via step 14. The container 402 may be submitted to a repair facility to repair the leak prior to continuing the process 1.

If, however, the inspector sees or otherwise has detected no indication or evidence of leakage from the container 402 via the “search container” step 10, the inspector may sample one or more of the sideports 404 via step 16 using a leak detection device. The sideport 404 may allow an individual to gain access to the valves within the protective housing 406 without opening the protective housing 406 and exposing the individual to a large amount of the chemicals that may be contained within the headspace 413.

For example, an apparatus may remove a sample of gas from one of the sideports 404 via step 16 to determine if there is a leak in a valve or seal within the protective housing 406. The apparatus may include any device capable of determining a chemical composition of a volume of air, such as, for example, a Draeger® detector or a multi-gas tester manufactured by Industrial Scientific Corporation (“ISC”). A Draeger® detector may measure the chemical composition in ppm. The multi-gas tester may detect an oxygen “lower explosion limit” (“LEL”) of a volume of gas. The multi-gas tester may test for the LEL by creating a combustion of the gas in the sample and sensing the heat produced. The heat produced is directly related to the percent LEL of the sample.

If there is evidence of a leak at the sideport 404, an assessment may be made via step 14 concerning whether the container 402 may be cleaned or whether the container 402 should be submitted for repairs. However, if there is no evidence of leaks from the sideport 404, then the seal of the inspector’s face mask may be broken so that the inspector may test for odors via step 20 at the sideport 404. If there is evidence of a leak then the leak may be assessed via step 14. For safety purposes, however, the inspector may not break the seal of his or her facemask to test for odors.

If there is no evidence of a leak or leaks during step 20, then the inspector’s facemask may be completely removed and the protective housing lid 412, as shown in Figure 4B, may be opened. The headspace 413 and the valves 408,410 may be inspected

visually via step 24. The inspector may note the valve types and damage to the valves, pipes, and/or fittings contained within the protective housing 406. If there is substantial damage to any valve, pipe or fitting or to the container 402 itself, the damage may be assessed via step 14 and a decision may be made as to whether the cleaning process should be continued. If the container 402 passes the inspection, then a cleaning process 100 may begin, as shown in Figure 2.

Referring now to Figure 2, a cleaning process 100 is illustrated. The cleaning process 100 may be utilized to clean the container 402 having an amount of a chemical therein. Specifically, the cleaning process 100 may be used to clean containers having LPG or AA, however any chemical or mixture of chemicals may be contained within the container as may be apparent to those skilled in the art.

The container 402 may have a tare weight printed in an accessible location, such as, for example, on a side of the container for easy visual access. The container 402, having been inspected for leaks pursuant to the inspection process 1 as shown in Figure 1, may be weighed via a "weigh container" step 102 and compared against the tare weight of the container 402 to determine a weight of the chemical contained therein. The amount of chemical is important to make projections concerning how the container 402 may be cleaned and how long the cleaning process may take to get the chemical out of the container 402. Alternatively, the "weigh container" step 102 may be skipped.

After the container 402 is weighed, it may be grounded via step 104 to minimize the possibility of a spark being generated that may ignite the hazardous chemical contained therein. Specifically, a ground wire may be connected to a ground lug on the container 402 or in any other locations apparent to a person having ordinary skill in the art.

After the container 402 is grounded, a pipe and a pressure gauge (not shown) may be attached to the vapor valve 408 via step 106. The vapor valve 408 may then be opened slowly to pressurize the gauge allowing an individual to note and record the pressure contained within the container 402. It should be noted that the valves 408, 410 on the container 402 and pipes attached to the container 402 may be any size and/or shape that may be apparent to those skilled in the art. The pressure gauge may indicate whether there is residual pressure of the chemicals within the container 402. If there is residual

pressure within the container 402, then a sample may be removed from the container 402 via step 112. However, if there is no residual pressure within the container 402, then the container may be filled with nitrogen gas through one of the liquid valves 410 and the container 402 may be filled to a known pressure via step 110 so that a sample of the nitrogen/chemical mixture may be taken from the container 402 via step 112. The pressure after addition of the nitrogen gas via step 110 may be above about 0 psi and below about 12 psi after nitrogen is added thereto. However, about 6 psi is preferable for removing a sample therefrom.

The nitrogen that may be used to fill the container 402 in step 110 or that may be added to clean the container 402 may be heated before entering the container 402. Heating the nitrogen serves the purpose of providing a large volume of nitrogen gas to aid in cleaning the container 402. Further, heating the nitrogen ensures that no liquid nitrogen enters into the container 402 to damage parts of the container 402. For example, liquid nitrogen may freeze important parts such as valves and pipes and further may cause the walls of the container to freeze and crack. As shown in Figure 4A, the nitrogen may be stored in a tank 414 and allowed to flow through a nitrogen vaporizer 416. Generally, the nitrogen vaporizer uses ambient temperatures to convert the liquid nitrogen into the gas phase. However, ambient temperatures may be relatively low depending upon where the system is located. Therefore, the nitrogen may then be vaporized by the addition of heat. The nitrogen may flow to a steamer 418 via a pipe 420 where the pipe 420 may be heated by steam to a desired temperature. The steam itself may be heated by boilers 419. Typically, the nitrogen gas may be between 100°F and 300°F but may preferably be 200°F. The nitrogen, however, should be at least 100°F or above to ensure that no liquid nitrogen flows into the container 402. The temperature of the nitrogen gas may be verified using a thermometer prior to entering the container 402. The heated nitrogen gas may then be added to the container 402 via an input line 426.

After the heated nitrogen gas is added to the container 402 to a pressure of about 6 psi via step 110 or if there already is residual pressure within the container 402, a sample of the chemical may be removed from the container 402. The pressure within the container 402, either residual or added via step 110, may allow the sample to be

withdrawn from the container 402. The sample may be withdrawn from any valve or pipe.

The container 402 may again be inspected for leaks via step 114. If a leak is detected around the protective housing area and the reading is about 10% or more of the LEL for liquefied petroleum gas or over about 50 ppm for anhydrous ammonia, then the leak must be assessed to determine whether the container should be removed from the cleaning process. If no leak is detected, then the vapor valve 408 may be closed and the pressure gauge may be removed.

The sample taken from the container 402 may be sampled, tested and verified via step 116. Specifically, a "commodity sampling device" ("CSD") may preferably be connected to the pipe leading from the vapor valve 408. However, the sample may be taken as noted with respect to step 112, from any pipe or valve having direct access to the interior of the container 402. The vapor valve 408 may then be opened to allow vapors within the container 402 to flow to the CSD. An amount of vapor, preferably enough to fill the sampling device to half full, may then be removed from the container 402. The CSD may be a Draeger® apparatus or any other sampling device and may be utilized to verify the identity of the contents of the container 402. This verification may ensure that the chemical or chemicals contained therein are properly identified and, therefore, handled safely and properly during the cleaning of the container 402. If the pressure of the chemical is over a predefined level, such as preferably 100 psi, or if the weight of the chemical within the container is above a predefined level, such as preferably 2000 pounds, then the container 402 may be removed from the cleaning process.

After the chemical material's identity has been verified via step 116, the vapor valve 408 may be attached to a flare line 422. For example, the flare line 422 may be attached to a hammerlock fitting that is on a 2" attached to the vapor valve 408. However, the flare line 422 may be attached to the vapor valve 408 in any way apparent to one having ordinary skill in the art. The flare line 422 may run from the container 402 to a flare 424, as shown in Figure 4A. The flare 424 may ignite to form a flame using ignited natural gas 433 as a pilot. Highly combustible chemicals, such as LPG, may be fed directly into the flare 424 and incinerated using the flame of the pilot to ignite the

chemicals. However, a flare ring may be ignited using the natural gas 433 to fully combust less combustible materials, such as AA. As shown in Figure 4A, the flare line 422 may allow the chemical to be fed into the flare 424 causing the hazardous chemical to be incinerated as it passes through the flare. Further, outside air 431 may be fed into the flare 424 using a blower with a motor 432 to aid in the burning of the hazardous chemical within the flare 424. Typically, the blower with the motor 432 may be utilized to aid in the burning of less combustible materials, such as, for example, AA or higher combustible materials at low concentrations. To ensure complete burning of the chemicals within the flare 424 the blower with the motor 432 and the flare ring may be used together. Further, the blower may be used with highly combustible materials such as LPG for smokeless operation of the flare 424. The flare 424 may be engineered to burn a plurality of different chemicals, such as, preferably, liquefied petroleum gas and anhydrous ammonia. For example, a flare engineered and provided by Tornado Technologies Inc. may be used in this invention for the burning of chemicals such as LPG and AA.

The vapor valve 408 may then be opened to allow the gas contained therein to vent to the flare 424 thereby incinerating the residual gas contained within the container 402 via step 118. During this process, the container may again be inspected for leaks. If the chemical detection meter shows a level of the chemical at a given level, such as preferably about 75% of the LEL for liquefied petroleum gas or about 50 ppm for anhydrous ammonia, then the leak should be assessed. Based on the severity of the leak, the container may be taken from the cleaning process for repairs. As the pressure is relieved and the gas is released, the chemical therein may be vented to the flare 424. When the pressure within the container 402 reaches a predetermined level, such as between about 0 psi and about 6 psi and preferably about 3 psi, then the vapor valve 408 may be closed. An indicator light (not shown) may show when the pressure within the container 402 reaches the predetermined level.

At this point, the heated nitrogen line 426 may be attached to one of the liquid valves 410 while the flare line 422 remains connected with the vapor valve 408. A pressure gauge may be attached to the other liquid valve 410. The heated nitrogen may then be added to the container 402 via step 120 to raise the pressure within the container

402 to a desired value. The desired value may be between about 10 psi and about 30 psi and preferably about 18 psi although any pressure is contemplated that may be apparent to those skilled in the art. The vapor valve 408 may then be opened releasing the gas to the flare 424 via step 122 thereby incinerating the chemicals that may be contained therein.

- 5 When the pressure reaches a desired value between about 0 psi and about 6 psi, preferably about 3 psi, the vapor valve may be closed.

The addition of heated nitrogen to the container 402 via step 120 and the subsequent venting to the flare 424 via step 122 may be repeated as desired so that the concentration of the chemical within the container 402 may reach a desired level. If the container 402 is not to be steam cleaned and is to be used to store and/or carry the same type of chemical that it had previously stored and/or carried and the concentration of the chemical therein has reached the desired level, then the residual pressure within the container 402 may be vented to the flare 424 via step 124 and the container 402 may be detached from all pipes and/or lines. It should be noted if the container 402 is not to be steam cleaned, a preferable concentration level of chemical within the container may be about 50% of the LEL for the liquefied petroleum gas or about 10,000 ppm for anhydrous ammonia. Typically, it may take a plurality of cycles of nitrogen gas to clean the container 402 to the desired level. For example, it may take six or more cycles to reach the desired level. However, any number of cycles may be performed as may be apparent to those skilled in the art. The container 402 may then be removed from the cleaning area and may be repaired or transported away.

However, if the container 402 is to transport and/or store a different chemical than previously contained therein then the container 402 should be steam cleaned via the steam cleaning process 200 shown in Figure 3. Further, if the pressure plate (not shown) on the container 402 is to be removed (for example, to thoroughly clean therein with steam, as shown in Figure 3), then the container 402 may be cleaned using heated nitrogen gas twice before the pressure plate is removed and the container 402 is steam cleaned.

Prior to steam cleaning via a process 200 shown in Figure 3, the container 402 may first be prepared for the steam cleaning. For example, a rail tank car may have a magnetic gauging device rod that may be removed or it may get damaged during the steam

cleaning. In addition, other devices may be removed from the container 402 in preparation for the steam cleaning process 200.

After the container 402 is prepared for the steam cleaning, a steam line (not shown) may be attached to the liquid valve 410 via step 202 for adding steam to the container 402.

5 The liquid valve 410 may then be opened to pressurize the container 402 with steam to a desired pressure via step 204. An adequate range of pressure may be between about 10 and about 20 psi, preferably about 15 psi. Alternatively, the container 402 may be pressurized for a period of time, preferably about three minutes. The vapor valve 408 having the flare line 422 attached thereto may be opened to vent the steam to the flare 424
10 via step 206. Residual chemicals that may still be contained within the container 402 may thereby be removed. The steam may be vented through the container 402 for a desired period of time, preferably about 30 minutes, to thoroughly clean the interior of the container 402. After the desired period of time, the liquid valve 410 may be closed allowing the container 402 to depressurize via step 208. The flare line 422 may be
15 removed via step 210 and the steam line may be moved from the liquid valve 410 to the vapor valve 408.

Pipes may be attached to the liquid valve 410 and may allow the steam flowing therethrough to be vented directly to the atmosphere. After the liquid valve 410 and vapor valve 408 have been opened, the container 402 may be steamed via step 212 for a desired
20 period of time, preferably about 3 or 3 1/2 hours. The waste steam may be vented through a pipe attached to the liquid valve 410.

After the container 402 has been steamed for the desired period of time via step 212, then the vapor valve 408 may be closed, and the steam therein allowed to vent to the atmosphere thereby depressurizing the container 402 via step 214. The steam line (not
25 shown) may be removed and an air line (not shown) may be attached to the vapor valve 408 via step 216. The vapor valve 408 may be opened and dry, cool air may be allowed to flow through the container 402 for a desired time period, preferably 30 minutes, via step 218 to allow the container 402 to become dry and cool.

After the desired time period is over, the vapor valve may be closed and all lines
30 may be removed via step 220. The pressure plate (not shown) on the container 402 may

be removed and the container 402 further allowed to cool via step 222. Finally, after the container 402 is cooled, the container 402 may be allowed to dry. Debris, such as residual scale and other deposits, may be removed via step 224 by fitting an individual within the container 402 with equipment to remove the debris.

5 The addition of heated nitrogen and steam and the subsequent venting of gases via the processes 1, 100 and/or 200 may be controlled by a control panel 430 having buttons, switches, lights, warnings, or any other controls or displays that may inform a user and allow a user to control the processes 1, 100 and/or 200 described above.

10 It should be noted that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications may be made without departing from the spirit and scope of the present invention and without diminishing its attendant advantages. It is, therefore, intended that such changes and modifications be covered by the appended claims.

CLAIMS

We claim:

1. A system for cleaning pressurized containers containing chemicals comprising:
a container having a quantity of chemicals therein wherein the container has a
5 plurality of valves for attaching a plurality of pipes thereto;
a nitrogen storage tank having a first pipe extending therefrom and attachable
to a first valve on the container;
a heating means wherein the first pipe is heated by the heating means; and
a flare having a second pipe extending therefrom and attachable to a second
10 valve on the container.
2. The system of claim 1 wherein the container is mobile.
3. The system of claim 1 wherein the container is a rail tank car.
4. The container of claim 1 wherein the container is disposed on a vehicle.
5. The container of claim 1 further comprising:
15 a boiler for boiling water to feed into the heating means.
6. The container of claim 1 further comprising:
a nitrogen vaporizer attached to a second section of the first pipe for
vaporizing the nitrogen from the nitrogen storage tank.
7. The system of claim 1 further comprising:
20 a liquid pipe attached to the first valve wherein the liquid pipe extends to a
bottom of the container.
8. The system of claim 1 further comprising:
a vapor pipe attached to the second valve and extending partially within the
container.
9. The system of claim 1 further comprising:
25 a protective housing disposed on a top of the container wherein the protective
housing houses the plurality of valves.
10. The system of claim 8 wherein the protective housing has a removable lid to
gain access to the plurality of valves therein.
- 30 11. The system of claim 1 further comprising:

a pressure plate on a top of the container wherein the pressure plate provides access to the interior of the container.

12. The system of claim 1 further comprising:

5 a platform situated adjacent the top of the container to aid an individual in gaining access to the top of the container.

13. The system of claim 9 further comprising:

a plurality of sideports on the protective housing wherein the sideports provide access to the plurality of valves housed within the protective housing.

14. The system of claim 1 wherein the flare incinerates a plurality of chemicals.

10 15. The system of claim 1 wherein the flare incinerates both liquefied petroleum gas and anhydrous ammonia.

16. The system of claim 1 wherein the flare has an inlet pipe for adding air within the flare.

17. The system of claim 16 further comprising:

15 a blower for blowing air through the inlet pipe into the flare.

18. The system of claim 1 further comprising:

a natural gas inlet attached to the flare for feeding natural gas to the flare.

19. The system of claim 1 further comprising:

20 a pressure gauge attached to one of the plurality of valves for measuring the pressure within the tank.

20. The system of claim 1 further comprising:

a control panel having a plurality of switches for controlling the system.

ABSTRACT

The present invention relates to a system for cleaning a pressurized container having at least one chemical contained therein. The pressurized container may be any type of container able to store chemicals under pressure. Preferably, however, the container may be a rail tank car. Generally, the system includes the container that may have a plurality of valves for adding or removing gaseous or liquid material to or from the container. The container may be connected with a nitrogen tank that may be heated via a heater. The container may further be connected to a flare for incinerating residual chemical material that may be removed from the container.

CHI99 3547795-1.047440.0018

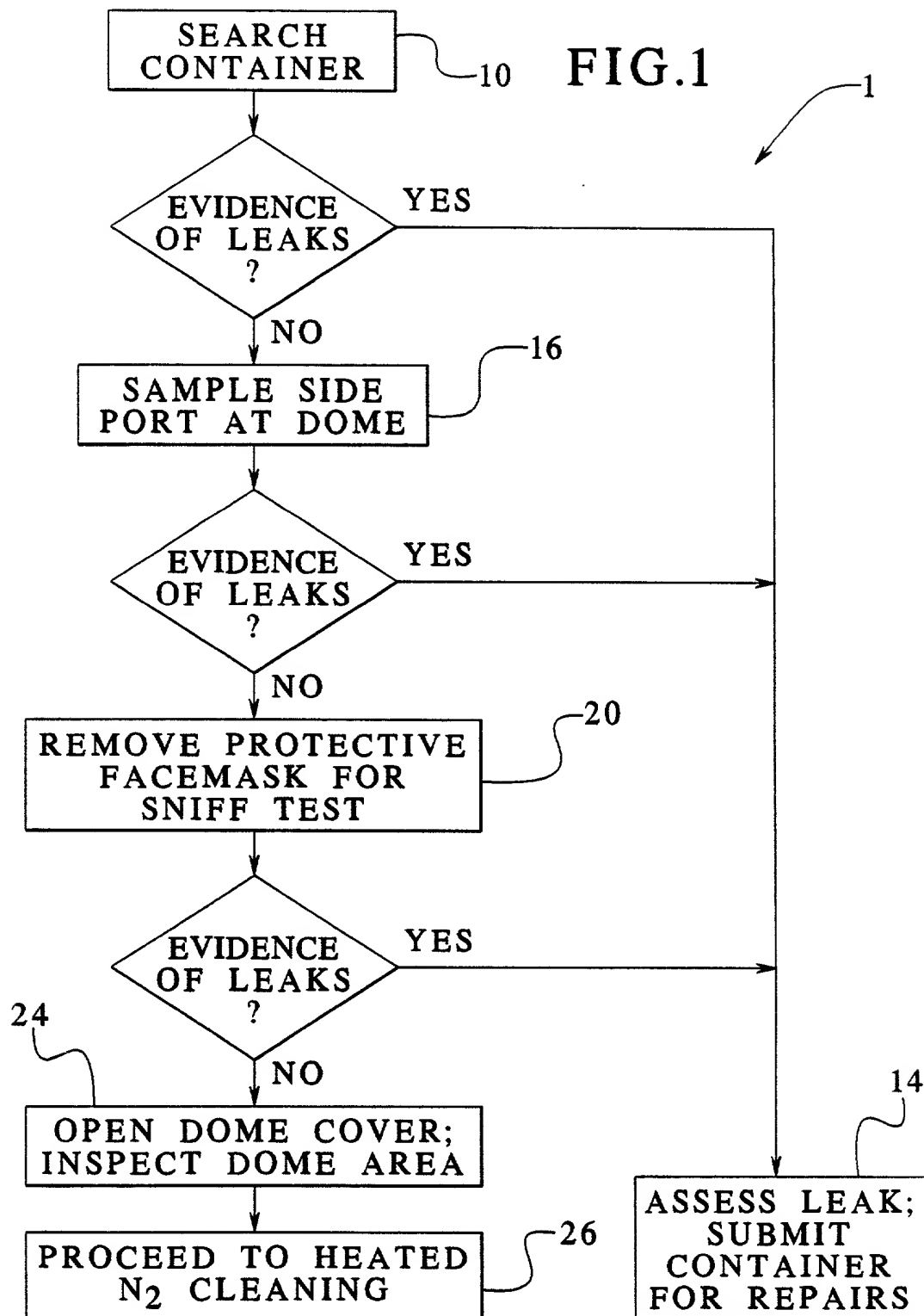
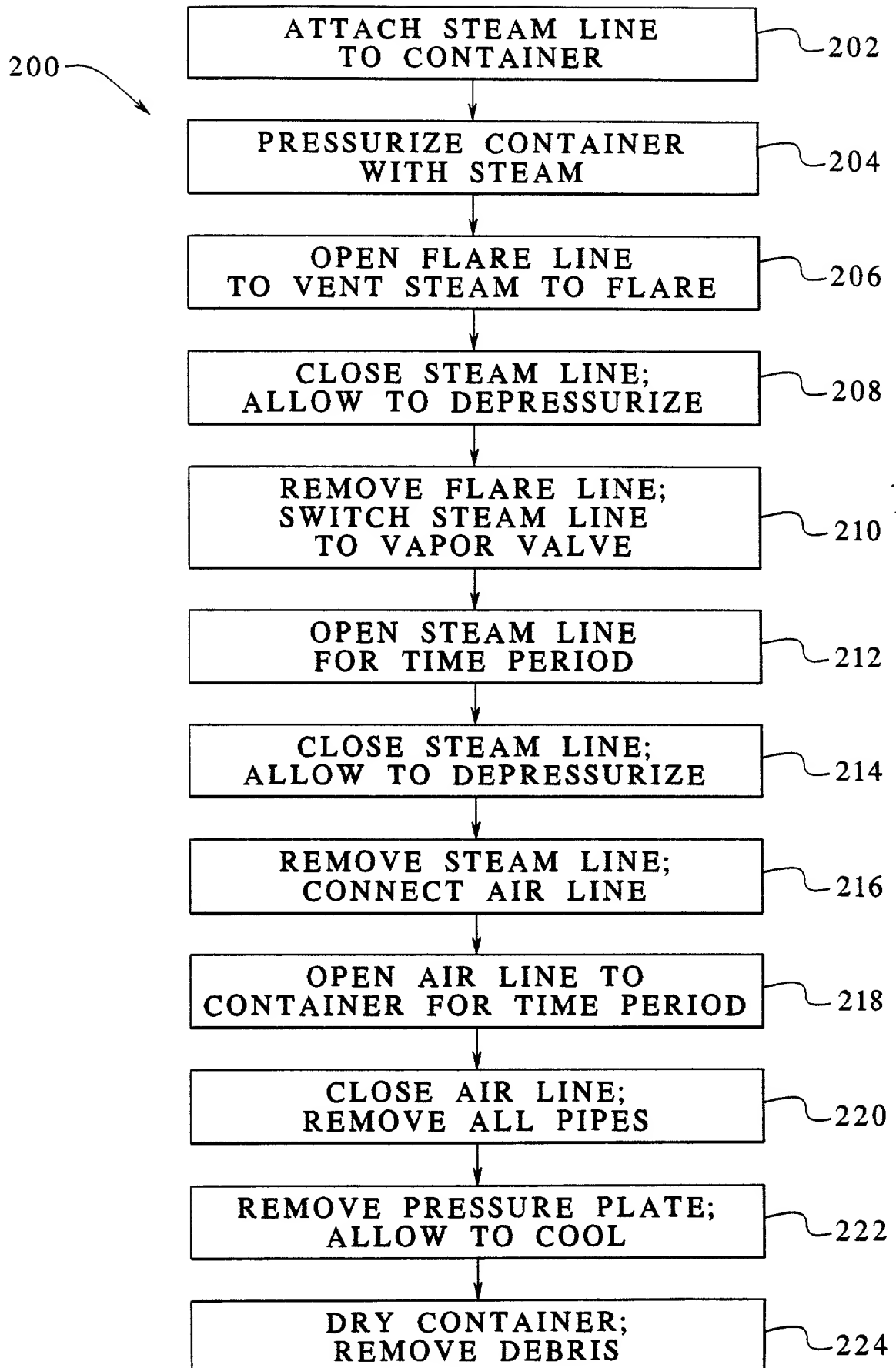
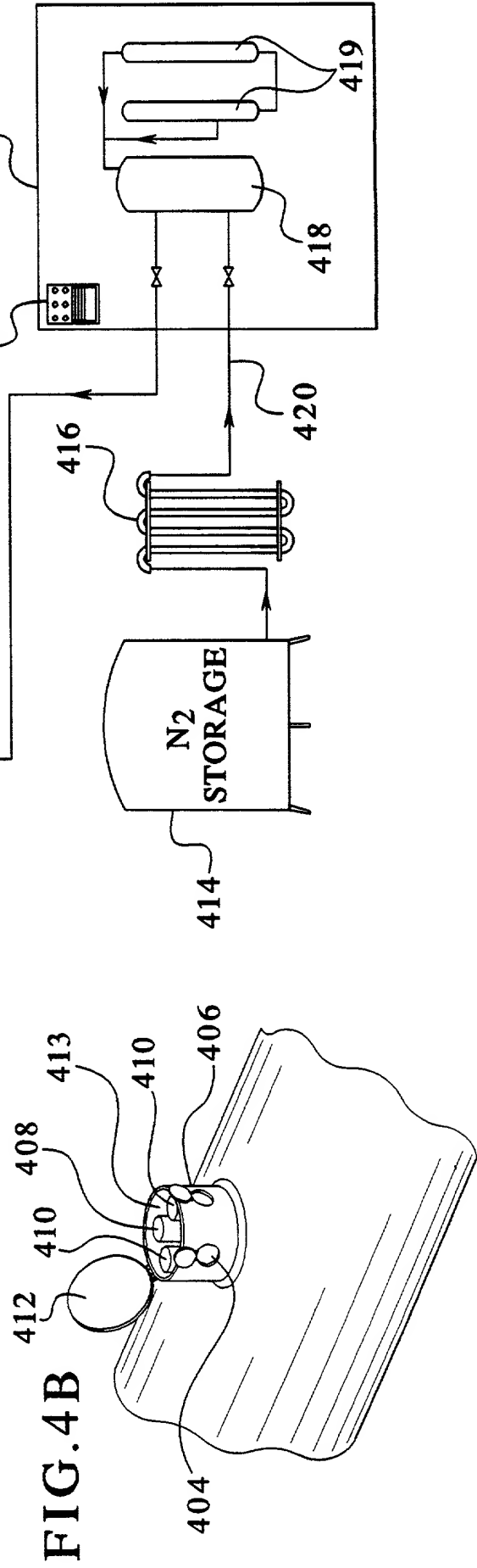
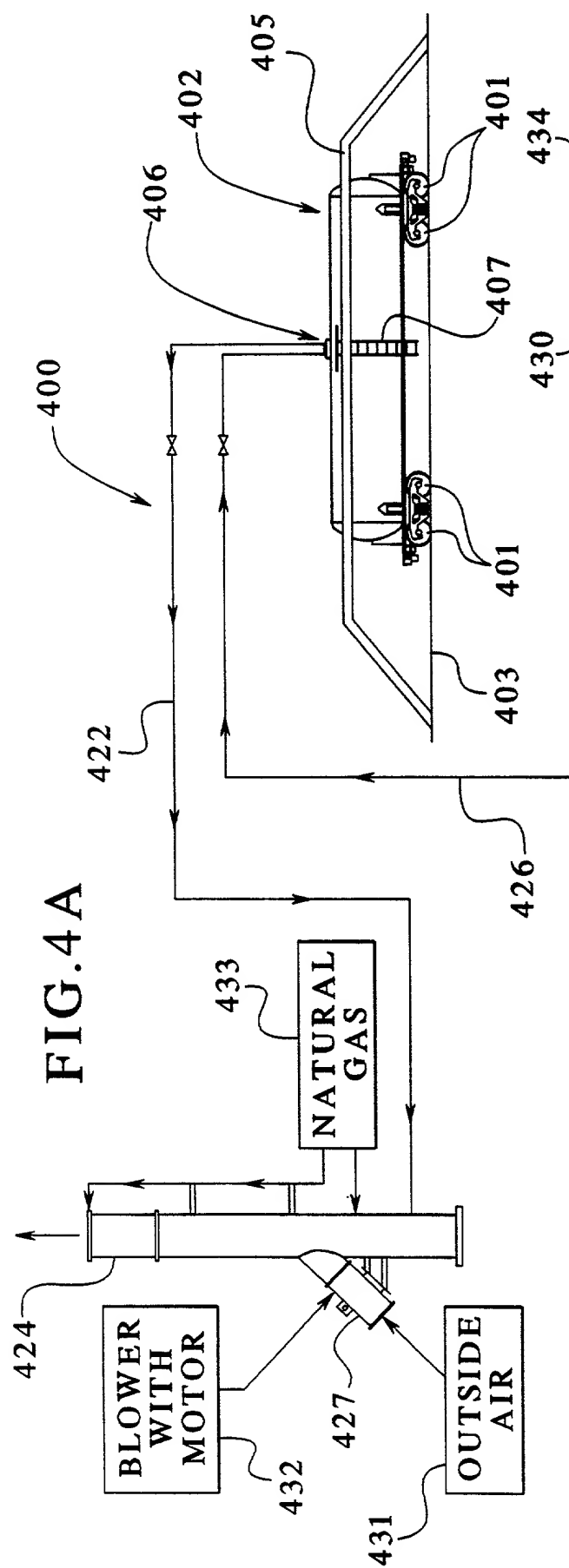


FIG.3





DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

<input checked="" type="checkbox"/> Declaration Submitted with Initial Filing <div style="text-align: center;">or</div> <input type="checkbox"/> Declaration Submitted After Initial Filing) <i>(Surcharge (37 CFR 1.16(e) required)</i>	Attorney Docket No.	47440 018	
	First Named Inventor	Joseph P. Tunney	
	COMPLETE IF KNOWN		
	Application No.	Not Assigned	
	Filing Date	Not Assigned	
	Group / Art Unit	Not Assigned	
	Examiner Name	Not Assigned	

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **A SYSTEM FOR CLEANING PRESSURIZED CONTAINERS**, the specification of which is filed herewith.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 USC §119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application Nos.	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached	
				Yes	No
None			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Application Number(s)	Filing Date (MM/DD/YYYY)	
None		<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

I hereby claim the benefit under 35 USC §120 of any United States application(s), or 365(c) of any PCT international application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 USC §112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
None		

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

Applicants hereby appoint Joseph H. Paquin, Jr. (31,647), Margaret M. Duncan (30,879), John Bisbikis (37,095), Tracy Thomas (38,633), Stephen Scherrer (45,080) and Joy Ann G. Serauskas (27,952).of McDERMOTT, WILL & EMERY, which has associated with it and with the power to appoint associate attorneys, as its attorneys, with full power of revocation, to prosecute this application, to transact all business in the U.S. Patent and Trademark Office and in the courts in connection therewith and to receive the Certificate of Registration

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

<input checked="" type="checkbox"/> Declaration Submitted with Initial Filing <div style="text-align: center;">or</div> <input type="checkbox"/> Declaration Submitted After Initial Filing <i>(Surcharge (37 CFR 1.16(e) required)</i>	Attorney Docket No.	47440 018	
	First Named Inventor	Joseph P. Tunney	
	COMPLETE IF KNOWN		
	Application No.	Not Assigned	
	Filing Date	Not Assigned	
	Group / Art Unit	Not Assigned	
	Examiner Name	Not Assigned	

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

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				Yes	No
None			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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